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AAN TACTICAL ROLES IN COMPLEX URBAN TERRAIN

A MONOGRAPH
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ABSTRACT

The Army After Next concept is a significant part of the U.S. Army's role in future operations. The proponents are developing doctrinal concepts that break current paradigms of multiple battlefield operating systems at the tactical level. The expectation is that technology will simplify and eliminate the need for engineers, air defense, and other forces at the tactical level. The infantryman will assume the responsibility for tasks such as mobility. However, many experts predict the future battlefields will consist of complex urban terrain where much of the world population is occupying. The complexity of the terrain will nullify or reduce a number of the technological capabilities of the future infantryman to accomplish his mission.

This monograph explores the lessons learned in current operations in complex urban terrain by two major technological powers, the United States in Somalia and Russia in Chechnya. The monograph identifies the distinct role of the infantryman and the engineer in the urban milieu. The analysis examines the expectations of previous urban conflicts and if the future technologies address the needs for the infantryman to accomplish them. The analysis examines the feasibility of the infantryman performing his mission using three leadership criteria. The criteria includes maintaining proficiency, physical stamina and each soldier's cognitive abilities. The principle research question is "Will technology be the critical enabler that optimizes the urban warrior's performance or are there associated engineer tasks that can be better performed by a specialized engineer enabler to optimize the urban warrior in a complex urban environment?"

The conclusions are that the infantryman can accomplish the common mobility tasks in a complex urban terrain with risk. The risks do not consider requirements for innovative solutions and the need for specialist as newer technologies such as robotics develop. The risks to the infantryman and mission accomplishment do not outweigh the resourcing of an engineer specialist capable of providing new technologies and innovative solutions.

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> "Armies are conservative organizations; they adapt themselves slowly to new environments, and especially to new mental surroundings. To-day [sic] a new epoch of war is dawning, and we are surrounded by a veritable fog of new ideas. We must neither accept them as they stand nor pass them by, but we *must* examine them and *test* out their values."[1]
>
> Colonel J.F.C. Fuller, 1926

INTRODUCTION

Colonel J.F.C. Fuller witnessed the events of World War I and the post war changes that occurred in technology. He eventually saw them integrated into doctrine. He understood the importance of critically viewing future warfare. He saw the need to take old concepts and replace them with new ones or face the surprise of our own ignorance. His words still ring true in 1998 as the United States Army attempts to identify future technologies and proposes new doctrinal concepts. Today's army is wading through a sea of technologies that will invariably impact directly on developing doctrine.

The United States Army is attempting to identify the Army After Next (AAN) future force structure by integrating the technologies of Force XXI and future systems to maximize their utility. Significantly, the current AAN battle force is not resourced with combat engineers at the tactical level. The emerging AAN "doctrine" suggests that the traditional engineer functions of mobility, countermobility, survivability, topography and general engineering may no longer require the skills of engineers in general and combat engineers in particular.

Emerging AAN advanced technology concepts hold that the future infantry soldier will be able to detect, breach, and proof obstacles as technology makes these skills

less technically complex. The AAN planners are resource constrained and have examined areas of potential redundancy. The current thought is that a number of traditional branches will not be required due to technological advancements that simplify and integrate functions by operating systems that are capable of performing multiple tasks. The future soldier, land warrior, or urban warrior is being developed to support the principles of AAN to exploit his ability to act faster than the enemy's decision cycle. He is expected to be proficient in a number of skills and capable of performing a myriad of tasks to accomplish his missions against a wide spectrum of anticipated threats.

In a recent AAN wargame, the OPFOR identified vulnerabilities associated with the AAN concept. AAN is based on using high-speed aerial and ground maneuver to gain positions of advantage over the enemy. The AAN vulnerabilities were exposed when the OPFOR entered large-scale complex urban terrain. The OPFOR was able to significantly degrade AAN targeting with precision guided munitions, reduce the capabilities of satellite-based systems and stall their movement, which exposed them to devastating direct and indirect fires.

Historically, engineers have played a critical role in all military operations, especially within the urban environment. Will the future technologies allow for the elimination of particular specialized forces like engineers? Engineers must examine their role today and reflect on how to best support the AAN or recognize their obsolescence in support of the infantryman and identify new roles external to the AAN. The army must understand that there is a danger in the infatuation of new technologies that seem to substitute for the humanistic aspects. The role of technology must be tempered by the human's limitations within a particular environment where technologies are unable to be

exploited to the maximum efficiency. Will technology be the critical enabler that optimizes the urban warrior's performance or are there associated engineer tasks that can be better performed by a specialized engineer enabler to optimize the urban warrior in a complex urban environment?

METHODOLOGY

This monograph uses primary and secondary sources to lay out an argument that shows the role engineers have played in the past using historical references and focusing on the most recent urban scenario in Somalia and Chechnya. It identifies the proposed "urban warrior" and all his potential technological capabilities, highlighting the engineer mobility functions integrated into his system. The current AAN proposal does not include engineers at the tactical level. The proposed question is whether future engineers are obsolete at the tactical level or is there still a need for specialists capable of providing mobility support to the future infantryman? For the sake of brevity, this monograph focuses exclusively on the mobility function in complex urban environment.

The majority of futurists agree that future soldiers will be expected to deal in a complex environment that requires a wide foundation of knowledge. The evolving AAN concept places the responsibility of leadership on soldiers at all levels. It will be the fundamental basis of success at the tactical level. The nine leadership competencies found in FM 22-100 must be embedded into every soldier. These leadership competencies were developed in 1976 from a study of leaders from the rank of corporal to general.[2] The study identified nine functions all leaders must perform if an

organization is to perform effectively.[3] Three competencies will be of particular importance to the future soldier in complex urban terrain. They are tactical and technical proficiency (physical stamina included), use of available systems and decisionmaking. Historically, soldiers in complex urban terrain tend to operate in small decentralized units and must draw upon their personal proficiency, physical stamina, and cognition of the required tasks to perform in the environment of close quarters combat. Three of the nine fundamentals of leadership are used as a theoretical underpinning in support of the argument.

The monograph uses these three criteria to identify whether the urban warrior will be capable of performing the traditional engineer mobility function in an urban environment. The criteria are derived from three doctrinal leadership competencies of FM 22-100 that apply to decentralized offensive operations in urban terrain. The leadership competencies are tactical and technical proficiency that includes *physical* stamina, use of available systems that includes *proficiency* to operate future systems and decisionmaking that will be described as *cognition*. This monograph refines the definitions for ease of evaluation. The criteria will include *proficiency* defined as the soldier's ability to perform the myriad of required tasks in the proper order in the required time to accomplish the mission. The second criterion will be *physical*. It will be defined as the soldier's ability to carry all the required technologies and still remain agile to perform the urban tasks. The final criterion will be *cognition*. Cognition is the soldier's ability to recognize the correct tasks to perform within a decision cycle without losing momentum during his mission. The monograph will argue that technology may allow the urban warrior to perform more efficiently, but there may still be engineer tasks

that require a trained specialist with specialized tools. The conclusion will identify other tasks that may evolve in the future and recommend the engineer school focus on these tasks to generate a consolidated doctrinal manual to support MOUT operations.

FUTURE BATTLEFIELDS IN COMPLEX URBAN TERRAIN

The United States military and futurists associated with the military point to the future and predict that future conflicts will be centralized within complex urban areas due to the significant population increases around the world.[4] Urbanization is a complex, multifaceted process influenced by many factors including a nation's cultural development, its economic resources, and its industrial capacity. Although its form varies from region to region, urbanization is characterized by a general pattern of changes in land usage and the spread of manmade features across natural terrain.[5] Over 160,000 people per day migrate to developing world cities, a number that will double the developed urban population by the year 2000 and quadruple it by 2025.[6] The RAND organization briefed the Military Operations in Built-up Areas (MOBA) Defense Science Board in 1994 that operations in urban areas may be unavoidable. They identified a number of characteristics that will include the need for specialized equipment and training.[7] This conclusion implies the need for specialized urban soldiers or units with more mission essential tasks, but do the specialized urban soldiers or more diverse units require specialized engineers?

All current sources tend to focus on the increased populations associated with future urban areas. However, the increased populations are part of a complex equation

that will affect military operations in complex urban terrain. The characteristics of the terrain will be another significant factor. The total volume of cities and their densities will be a critical factor that allows the enemy to impede the AAN's mobility. Cities will expand proportionately with their populations with more underground infrastructure below the surface and higher buildings over a greater disbursed area.[8] The army will encounter a great deal of resistance as they attempt to project their mass through the dense complex urban terrain. Future doctrine may reflect a more isolated approach where small units control a small area and surgically remove the enemy.

The army's current intelligence preparation of the battlefield doctrine for conventional operations typically describes these complex urban areas as "no go" or "restrictive" terrain. The TRADOC Analysis Center (TRAC) at Fort Leavenworth, Kansas, refers to complex terrain as any terrain that severely complicates or limits freedom of maneuver, tactical and operational choices, and the ability to achieve and maintain battlespace awareness.[9] Complex urban terrain is only one type of the complex terrain described above. Complex urban terrain consists of large, heavily populated heterogeneous urban expanses that present a unique operating environment to both current and future military forces.[10] This environment allows enemy forces to employ asymmetrically and limit the inherent advantages of knowledge and speed.[11] The 1994 MOBA Report identified a number of reasons why the United States Army avoids urban warfare. They include lack of detailed preconflict intelligence of urban areas, intensive manpower requirements, slow tempo of maneuver forces, desire to minimize noncombatant casualties and damage to population centers, etc.[12] Therefore, friendly conventional forces bypass urban areas and focus on the enemy's massed forces. This is

described as the western way of war, i.e., to focus on the massed enemy force and annihilate it. This is a fundamental concept for the organization structure of the AAN. However, increased population and expanding urban environments will increase the probability of U.S. forces conducting operations in cities on a grand scale. Historically, combat in cities has been a battle of attrition. As a result, the AAN is vulnerable when exposed to an environment where attrition occurs.

The AAN looks to maximize the intelligence gathering capabilities and improved weapons capabilities of Force XXI and increase the speed and movement of its systems. The Army's Vision 2010 is the conceptual template for how the United States Army will channel the vitality and innovation of its soldiers and civilians and leverage technological opportunities to achieve new levels of effectiveness as the land component member of the joint warfighting team.[13] The United States Army looks to increase the technological advantage over future adversaries. The Army's organization will reflect the increase in technologies embedded into weapon systems with a smaller personnel structure. Threat forces will attempt to identify the vulnerabilities associated with the AAN to achieve their political objectives without U.S. interference. AAN is based on speed and maneuver and maximizing the effect of stand off weapons systems and intelligence systems with minimal exposure of personnel to direct fire/close combat. Therefore, how does an opponent slow down the force, reduce maneuverability, eliminate stand off, and limit access to satellite based intelligence systems?

The North Vietnamese in the Battle of Hue quickly and correctly ascertained that "hugging the belt buckle" of American forces in an urban environment was the way to avoid annihilation by stand off weapon systems.[14] The U.S. forces were not prepared for

close-in fighting and the results were costly. "There is a danger in building [an AAN] force structure that can't adapt to unfavorable circumstances, it is that one's own enemies are constantly posing those unfavorable circumstances."[15] All these vulnerabilities were identified and capitalized on during the 1997 AAN Winter Wargames. The OPFOR commander rapidly occupied complex urban areas with his forces prior to the arrival of U.S. forces. The threat occupied allied urban areas and prepared corps and division-level defenses in depth in the urban terrain. "Opposing troops had captured the cities of key allies and dug into the urban terrain, forcing nasty, close in fighting by plain old infantrymen," said Richard Newman of US News and World Report.[16] Time and ability to rain destruction on the enemy force without harming millions of innocent civilians limited the United States. The United States was forced to confront the enemy in a complex urban environment that doctrine says should be avoided. The AAN battle force's high technological advantages were eliminated. The Marine Corps and Coalition forces were forced to deliberately and systematically clear the city with the limited number of infantry personnel available. The result was the recognition for a "future warrior" capable of conducting combat operations in an urban environment. The future warrior's systems are being designed to embed the capabilities of many battlefield operating systems eliminating the requirement for specialized individuals such as engineers in particular.

"The future is not the Son of Desert Storm, but the Stepchild of Somalia and Chechnya."[17]

LTG Martin Steele, USMC

RECENT LESSONS LEARNED

LTG Steele suggests that the future of warfare is changing from a conventional, symmetrically balanced war to an unconventional, asymmetrically unbalanced conflict. During the early 1990's, the two major super powers of the cold war were involved in independent urban operations in Somalia and Chechnya. Each nation learned some hard lessons and identified the criticality of mobility in the conduct of military operations. Historically, the engineers have played an integral part of the force structure in urban operations. These two case studies provide current scenarios in urban environments where technologically superior forces confronted small guerilla forces in complex urban terrain. Each case study identifies the critical roles of infantry and engineers played in providing mobility through the urban area and will be the foundation for analysis of the feasibility of the Urban Warrior project in future operations.

SOMALIA

In December 1992, the United States participated in Operation Restore Hope with joint and multinational forces in Somalia based on United Nation Resolution 794.[18] The 10th Mountain Division (Light) was one element of the Joint Task Force. The Resolution authorized soldiers to "use all necessary means" to ensure food was distributed to

starving Somali civilians.[19] The operation was initially a peacekeeping mission that evolved into peace enforcement. Operations were directed in Mogadishu and surrounding cities. Mogadishu, Somalia is a city of approximately 500,000 people that may have swollen to in excess of 1.5 million from the flow of refugees during 1993.[20] Another large city where operations were conducted was Kismayu, a southern port city, with a population in excess of 100,000.[21] Elements of Task Force Mountain included the organic 41st Engineer Battalion with combat engineers. These combat engineers were directly involved with the infantrymen in bitter street fighting within both Mogadishu and Kismayu.

The enemy situation drove the United Nation's Resolution. The country was in the midst of a civil war between various warlords. A recent drought in the country created a desperate situation with thousands of starving civilians. Muhammad Farah Aideed, a local warlord, controlled central Somalia. Muhammad Omar Jess controlled the southern region that included Kismayu.[22] As United Nation's relief efforts were made to supply food and supplies, the gangs fought amongst themselves for territorial access to steal the relief supplies.

In the spring of 1993, tensions increased with the local population during relief efforts in Kismayu. Somali gunmen fired small arms randomly into civilian crowds. An infantry brigade with an engineer platoon was tasked to cordon and search the city of Kismayu. The intent was to facilitate the movement of relief supplies for distribution within the cities. The infantry task force organized a house-to-house sweep of the city. The search was slow and meticulous as soldiers systematically moved through and secured the area. The operation took three days and consisted of several firefights within

the confines of the urban terrain.[23]

The infantry battalions in Kismayu participated in numerous tactical missions and identified a number of critical lessons learned for the infantryman in urban terrain. Some of the lessons appear contradictory or conflicting but present the difficulty of accomplishing their mission.

The infantry battalions identified the requirements of their mission and organized the forces into squad-sized search teams capable of decentralized operations. They identified that platoons were too large of a signature to maneuver within the city and fire teams as too small to achieve force protection.[24] The size of the unit directly affects the other lessons. The small unit had to be self-contained to conduct independent mobility operations. Squad leaders had to be resourced to accomplish all their required and anticipated tasks. If the squad forgot a critical piece of equipment, they would have to do without. Junior leaders had to be capable of quickly assessing each situation and reacting with potential repercussions at the strategic level.

The units identified the intensive physical and moral demands associated with an enclosed milieu. They identified that most engagements were between 10-25 meters and usually at night and over in a matter of seconds.[25] Therefore, soldiers have to maintain situational awareness at all times in order to anticipate and react. The implied requirement for each individual infantryman is their complete focus on scanning in all directions as they move forward. A high state of vigilance must be maintained which can be very stressful to the soldiers involved. A short period of distraction can very well cost a soldier his life and failure of his mission.

Force protection is always of paramount concern to U.S. forces. The lesson

learned was that troops must be trained to shoot their individual and crew-served weapons while wearing body armor and helmets. Not every soldier likes to wear their heavy, hot equipment because of the discomfort associated with wearing it. But the 10th Mountain Division infantrymen learned the importance of wearing this equipment as shrapnel and other debris was flung around the urban area during engagements. The 10th Mountain Division recommended that soldiers should be trained to run 100 yards in full load-bearing equipment helmet and body armor.[26] The conclusion was that soldiers eventually become acclimatized and their physical conditioning improves. Although cumbersome, the equipment is credited with saving more than one life in Somalia.

The opposite lesson was learned as well. If soldiers wear too much equipment, they are hindered in accomplishing their mission. Soldiers should wear the minimum amount of equipment due to extreme heat, physical exertion and the need to move quickly through crowded and restrictive areas.[27] The lighter load gave soldiers a better opportunity of dealing with the fleet Somali gunmen.[28] Soldier's with lighter loads were able to rapidly react and pursue suspicious civilians. Extremely heavy loads caused muscle fatigue that directly affected marksmanship. The 10th Mountain Division identified the need for infantrymen in an urban environment to be able to stop, aim and hit a target in three seconds or less.[29]

Another resource-constraining lesson learned is the need to bring special equipment to conduct mobility operations within a complex urban environment. This is a result of a wide variety of potential situations they could encounter within the complex urban environment. Soldiers brought sledgehammers, axes, chainsaws and bolt cutters for forced entry required. Each tool served a specific purpose of cutting wood or metal

and forcible entry. However, each specialized tool resulted in additional weight to bear as opposed to using tools with multiple uses.

The 10th Mountain Division (Light) after action review described the engineer organization as *supplemental* to the infantry. Engineers were organized similar to the infantrymen with the same forced entry tools. The major difference is the sapper platoon can be used for more thorough searches of buildings and because they had the heavier, specialized equipment to rip up floors and excavate wells or shafts.[30] As the mission changed from peace keeping to peace enforcement, the need to identify and collect Somali weapons pushed the use of metal detectors to the forefront. They also required mine detectors for searching for buried weapons, in yards or under floors.[31]

In June 1993, a Pakistani convoy was ambushed and, as a result, an aggressive cordon and search and seizure operation was conducted on suspected Aideed strongholds within the city. Engineers were utilized with military police at checkpoints to search detainees with metal detectors. They discovered many weapons hidden under the Somali's thick layers of clothes.[32]

During the incident with the U.S. Army Rangers, the engineers of C Company, 41st Engineer Battalion were enroute to support the fighting and became engaged and pinned before they could reach their objective. They were part of a Quick Reaction Force (QRF). Engineers cleared numerous road blocks enroute to facilitate movement of mechanized forces. As they were ambushed at the roadblocks, the engineers conducted mouse-holing operations into adjacent buildings to allow forces to withdraw out of direct fire weapons. Sappers on previous raids created an expedient breach charge by filling a U-shaped picket with 8 pounds of C-4 explosive compound.[33] This allowed access for

the infantry into an adjoining building. This method resulted in injuries to U. S. soldiers within a 100-meter range.[34] The lesson learned was the need for trained engineers capable of indirectly accessing or creating alternate entry means to avoid encountering mines/obstacles and facilitating rapid and safe advancement of the infantry. A second lesson was the need for mine detection capabilities to search for buried or hidden weapons. The paramount threat to U.S. mobility within the city was vehicular mines along the main supply routes (MSR). A number of vehicles struck mines while in Somalia. Engineers were required to conduct MSR mine sweeps to identify and eliminate threats. On 19 August, UNOSOM sustained two minor casualties from the first of several command-detonated mines along the MSRs.[35] The soldiers of the engineer battalion provided experts to quickly fabricate a forklift mounted mine roller from tracked-vehicle road wheels and angle iron.[36] This type of innovation should be inherent in all organizations to adapt to unforeseen circumstances.

CHECHNYA

After the Gulf War, the Soviet Union encountered a very difficult period of political turmoil that would lead them into a contrasted and more violent type of urban warfare. On 6 September 1991, the Republic of Chechnya revolted and declared their independence.[37] Over the next 4 years, guerilla factions fought for their independence within Grozny and the surrounding area. Russia was confronted with civil unrest in the capital city of Grozny, Chechnya that would force them to commit combat forces. On 11 December 1994, Russian conventional forces were called into Chechnya to suppress the

militants.[38]

The enemy situation in Chechnya was even more violent and dangerous than Somalia. A significant Chechen leader, Shamil Basayev, led a faction of guerillas that opposed the Russian forces. The small band of forces gained combat experience prior to their Russian confrontation in smaller fights around the Caucasus. They fought next to the Azerbaijanis and were trained by the Mujahadin in Afghanistan and Pakistan.[39] The experience and training the guerillas garnered prior to the war would make the resistance in the urban area of Grozny both intense and costly to both sides. The Chechen resistance would last for 21 months.[40]

The Russians entered the city with tanks, armored personnel carriers, and a limited number of infantrymen. They were ill prepared for urban combat operations. The Chechens occupied positions throughout the city and used antitank systems to destroy 105 of the Russians' 120 tanks and personnel carriers.[41] The Russians learned immediately four lessons 1) all approaches to the city must be sealed off while detailed reconnaissance proceeds, 2) key installations and buildings on the outskirts of the city must be taken once artillery has suppressed defenders and assault positions have been occupied, 3) the cities residential, industrial, and central sections must be taken successively, and 4) trapped enemy units must be eliminated, mines cleared, weapons collected and military control and curfew established.[42]

Russian forces identified the necessity to control industrial sites that were constructed of concrete and stone walls with lengthy underground rooms and passages because of their defensive significance.[43] The Russian infantry attempted to seal off areas and encircle the militants. The Chechens would hinder the technologically

advanced forces by impeding their movement. They mined doorways of buildings, mined corpses of Russian soldiers and would lock animals in mined buildings to attract attention to them.[44] Rebels secured sites and laid mines along routes of withdrawal.[45]

The Russians organized their infantry into storm groups. Each storm group consisted of a motorized rifle company reinforced with a tank platoon, artillery battery, mortar platoon, AGS-17 automatic grenade launcher platoon, engineer platoon and chemical troops.[46] This unit was more than the commander could deploy and control.

There was a significant amount of engineer lessons learned as well. The senior engineer for the operation reflected on the lessons learned in Stalingrad that were relearned in Chechnya. Russian engineers were not properly trained in mobility tasks such as removing mines and booby traps. They initially lacked the knowledge to create passages between buildings.[47] With experience, engineers learned to effectively blow entryways through the walls.[48] Two three-man teams were organized to clear each room. Enemy avenues of approach, such as doorways and sewers were mined and booby-trapped.[49] Once a building was captured, it was prepared for defense to impede the threat's mobility.

The load the Russian soldier carried was substantially heavier in urban scenarios. The Russian infantryman realized the need for increased supplies of hand grenades, demolitions, and light AT weapons. In addition, each soldier required rope, grappling hooks to enter buildings and limited light-weight ladders to enter buildings indirectly.[50]

A significant lesson learned was the need to improve the technical tools the troops used to accomplish their assigned tasks. They highlighted the need to give engineers a detection capability other than the dismounted sappers with hand-held mine detectors.

They required a remote detection capability but did not directly address the subject. This is significant with the problem of booby traps and mines that are field expedient or have deteriorated and are unpredictable.

A civilian journalist, Igor Korotchenko, who followed the Battle of Grozny reflected on a number of lessons learned and concluded the need for dramatically increasing the use of specialized troops. He did not specify whether that means more soldiers trained on MOUT or more supporting troops with special abilities.[51]

The two most recent operations in complex urban terrain demonstrated that a technologically superior force should have provided the advantage to conclude operations decisively, but failed. Both scenarios reveal the same conclusions that the MOBA report drew in 1994. The MOBA concluded that actions tend to be dismounted at the fire team and squad level and that the operational advantages associated with long range, high technological weapons based on the principles of mass and mobility tend to be reduced or negated in complex urban terrain.[52] Urban fighting tends to include a wide variety of terrorist-like activities such as car bombs, land mines, booby traps, acts of violence toward individuals, coupled with conventional operations that increase the vulnerability of the infantry soldier. The two case studies provide interesting lessons on the flexibility of the infantry to perform mobility operations but also highlight the need to develop new equipment and procedures to reduce casualties and increase mobility in the future.

URBAN WARRIOR TECHNOLOGIES

> The Assistant Secretary of the Army for Research, Development and Acquisition [ASA(RDA)] wrote to the Chairman of the Board on Army Science and Technology in March 1988 to request a study under the auspices of the National Research Council. The study's goal would be to assist the Army in improving its ability to incorporate advanced technologies into its weapons, equipment, and doctrine. The time period to be addressed was specified to extend at least 30 years into the future. The three study objectives stated in the request were to (1) identify the advanced technologies most likely to be important to ground warfare in the next century, (2) suggest strategies for developing the full potential of these technologies, and (3) project implications for force structure and strategy of the technology changes.[53]

The Army Science and Technology 1988 study became the genesis of the Army After Next concept. The purpose of the Army After Next Warfare Project is to examine the conduct of military operations in and around complex urban terrain in the 2025 timeframe with a primary emphasis on warfare at the operational level.[54] The Army After Next process looks to develop a reduced force structure that takes a significant amount of technology and embeds it into future operating systems. Many combat and combat support forces such as engineer, air defense, and military intelligence will be eliminated to reduce the force structure. The contention is that technology will substitute for the need of an engineer specialist to perform manual and/or mechanical methods of engineer mobility support. The Army and Marine Corps are both concurrently developing the future capabilities organic to the individual soldier. The Marine Corps has done a significant amount of work in the area of a specialized urban warrior. Their experimental phase started September 1997 and will conclude in March 1999.[55]

The Army modernization effort is a comprehensive, multifaceted program

designed to maximize the operational capabilities of the soldier as a "battlefield system" capable of executing a full range of military operations by enhancing command and control, lethality, survivability, sustainability, and mobility.[56] The "Urban Warrior" is a Marine Corps experiment to examine new concepts, tactics and technologies for combat in cities and urban environments.[57] The USMC and U.S. Army co-sponsor the MOUT Advanced Concept Technology Demonstration (ACTD).[58]

The experiment identified the importance of the individual soldier in close combat. The increasing technical sophistication will not eliminate the involvement of soldiers in future conflicts. Each soldier will be required to perform more complex tasks with more sophisticated equipment. Therefore, the AAN concept is to view the soldier as a system and expand/consolidate his tasks with enabling technologies.

AAN proponents view small unit leadership and training as critical to the success of the unit in the labyrinth of the urban environment. The Marine Corps warfighting laboratory identified that small fire teams were difficult to control within built up areas resulting in separation of units. Squad leaders and below were forced to make decisions normally reserved for platoon leaders.[59] The decision-making demands of the urban environment has forced the military to review how to train subordinate leaders capable of assimilating more information, more rapidly.

Historically, the majority of soldier casualties in the urban environment occur while soldiers move between buildings.[60] This is the period of maximum vulnerability as there is minimal cover or concealment for the individual infantryman. Therefore, mobility is the critical function that many proposed technologies will integrate into the "urban warrior." Mobility is defined as the ability to move about the battlefield with

accompanying load to execute assigned missions.[61] The traditional role of the engineers was to enhance freedom of maneuver of combat forces by defeating, bypassing, breaching, marking, and reporting mines and other obstacles, crossing gaps, and providing combat trails.[62]

The current system being developed for the individual infantryman is the Land Warrior (LW). It is the basis for what the urban warrior will carry into battle. The system is a first generation modular, integrated fighting system. The LW is composed of 6 integrated subsystems; Weapon Subsystem, Integrated Helmet Assembly Subsystem, Computer/Radio Subsystem, Software Subsystem, Protective Clothing and Individual Equipment Subsystem and System Interface and Control Subsystem.[63] The first unit equipped is currently scheduled for between 2000 and 2001. The Army is currently planning on contracting for 34,000 systems plus spares. The Land Warrior will integrate the dismounted infantryman with clothing and equipment needed to enhance his lethality, survivability, mobility, and sustainment and provide situational awareness and target acquisition.

The AAN infantryman will have an Integrated Helmet Assembly Subsystem (IHAS) which will use advanced materials to provide ballistic protection. The IHAS is lighter than the current kevlar helmet.[64] However, the IHAS's helmet will have a mounted computer and sensor display. The IHAS will interface to the other subsystems on the soldier and to the digital battlefield. The system will allow the soldier to view computer-generated graphical data, digital maps of the terrain, intelligence information on the threat, friendly troop locations and imagery from his weapon-mounted Thermal Weapon Sight (TWS) and video camera.[65] The TWS and video camera is a new

capability that will allow the soldier to view around a corner, acquire a target, then fire the weapon without exposing himself.[66] A Night Sensor Display (NSD) will integrate a helmet-mounted display with an image intensifier for access to his computer sensors.[67] This capability will allow the soldier to maneuver and engage targets under minimal illumination.[68] However, the complex urban environment has a large number of areas to include in sewers or buildings with no illumination that may minimize the utility of the NSD.

The Land Warrior will integrate a Computer/Radio Subsystem (CRS) into the backpack frame in two sections. The upper portion contains two radios; the squad radio and the soldier radio. The lower portion of the backpack contains the actual computer and the global positioning system (GPS) modules.[69] The program managers integrated the GPS and radio into the CRS to eliminate separate displays but more importantly reduced the weight and power requirements. The infantryman will have a menu driven display controlled the Remote Input Pointing (RIP) device. This RIP device is located on the chest strap and is operated by the touch of a finger.[70] Some functions are controlled with two buttons located near his trigger finger, allowing the soldier to maintain a firing position.[71] This is significant requirement because both of the soldier's hands are occupied. The antennas for the GPS and soldier radio are embedded into the load-carrying frame reducing the number of attached peripheral items but establishing a fixed weight. The soldier is unable to reduce or eliminate any of the basic configuration. The software subsystem allows the soldier to tailor the display, menus and functional operation of his system to his own mission needs and preferences. For instance, if a soldier expects to encounter mines, he may load a software package with procedures for

disarming mines. These expanded capabilities will also give each soldier the ability to communicate with the other members of his squad and/or perform independently. The system will greatly improve situational awareness and survivability through increased command and control.[72]

The Weapon Subsystem features the Army's Modular Weapon System, an M16 rifle/M4 carbine modified by a kit that replaces the front hand guards with standard rails.[73] This will allow the soldier to mount only those items needed for a particular mission in a specific environment. The Weapon Subsystem includes key electrical optical components such as the TWS, video camera, and the laser rangefinder/digital compass (LRF/DC) linked into the IHAS.[74] The LRF/DC provides the soldier with range and direction information to an identified target. The LRF/DC can then be used in conjunction with the individual's location from the GPS allowing an accurate target location when calling for indirect fires and for combat identification of unidentified forces.

The Protective Clothing and Individual Equipment Subsystem consists of a backpack frame design based on state-of-the-art automotive racing technology which bends with the soldier's natural body movements.[75] The electronic cables are integrated into the frame for the soldier's computer/radio connections. The soldier can adjust his backpack frame to adjust the load distribution from his shoulders to his hips while on the move. The system is adjustable and allows the soldier to manage and carry his combat load more effectively and with less fatigue. The new Land Warrior body armor is made of similar materials as the helmet. The body armor provides improved ballistic protection at a reduced weight from today's conventional body armor. The Land Warrior body

armor includes a modular upgrade plate to protect the soldier against the small arms threat.

The AAN soldier that will fight in the urban scenario will integrate and superimpose specialized technologies upon the Land Warrior system. The Army is the proponent on a number of current advanced technological developments for the urban environment. They are developing weapon systems to accompany the infantryman. The Javelin is a system currently fielded with the capability of defeating tanks with conventional and reactive armor. It can be used to defend against targets up to 2000 meters. The Short Range Assault Weapon (SRAW) will be capable of defeating enemy forces in reinforced concrete or brick buildings. The system weighs approximately 20 lbs. and has a range of 20 to 500 meters.[76] The SRAW will allow access by blowing holes into buildings with a safety standoff distance.

The future soldier will have access to joint Army/Marine Corps technology demonstrations in mine detection technology. The future man-portable mine detector will have the capability to detect both metallic and nonmetallic mines and other devices. It is similar to the current systems but will be more sensitive and provide the capability to detect nonmetallic mines, which is lacking in today's technology.[77] The mini-mine detector, smaller than the man portable, is a battery operated, handheld system that can detect metal content as low as one gram.[78] The handheld developments will provide a capability of immediately identifying mines, but the operator must constantly be cognizant at all times of detector output and make a final decision on the identification of a mine or a false reading. The high false alarm rates are induced by manmade and geological clutter. Current technologies allow minimal differentiation between mines

and nonhazardous debris. In testing as much as 95% of suspected anomalies were nonordnance items. This is phenomena is more complicated within the urban environment. Over 70% of the soldiers' time will be consumed excavating or searching for detected anomalies.[79] These results are based on over 60 commercially available systems tested from 1994 to 1996.[80]

A great deal of technological research has been done with Foam technologies for neutralization of mines and booby traps. There are currently two types of foams being tested: rigid and liquid. The rigid form is a mine marking and neutralization foam made of a polyurethane-base and rapidly hardens to a mine or trip wire. The foam impregnates the exposed areas of the mine and then hardens rendering the fuze inoperative. The technique would then require a string attachment so the mine can be pulled away and removed.[81] The LEXFOAM is a nitromethane-based liquid explosive foam. It is a commercial blasting agent. It is sprayed directly onto the mine and detonated. The Marine Corps Warfighting Lab has done a great deal of research in this area. They have studied over nine commercial variations of liquid and rigid foam. The current size of the backpack configuration assets range from 3 to 28 pounds depending on the amount of foam required. Twenty-eight pounds is over 1/3 of the total weight a soldier expects to carry.[82]

"“General Dragomiroff's devotion to the bayonet,” I remarked, “reminds me of our admirals' devotion to sails in our navy. Fifteen years ago it was quite obvious that the fighting ship of the future had no need for sails—that, indeed sails were an encumbrance and a danger; but all the admirals of the old school attached far more importance to the smartness in furling and unfurling sail than they did to proficiency in gunnery or in any of the deciding factors in naval battles. They clung to masts and yards for years after all the younger officers in the service knew that they might as well have clung to bows and arrows; and I suppose you will find the same thing in regard to the bayonet.”"[83]

Jean De Bloch, 1914

ANALYSIS

The statement posed by Jean De Bloch in 1914 must be addressed in the future AAN organization as new concepts develop and old ideas become antiquated. Are the roles of today's combat engineers obsolete in the future Army After Next force structure as proposed? Are the engineers holding on to their importance in the urban environment because in the past they held a place of high esteem? Can the future urban warrior perform all assigned tasks with new technological enabling advancements? The operations in Somalia and Chechnya are a glimpse of future military operations and mission expectations. The case studies of Somalia and Chechnya identify some common mobility tasks that the individual infantryman must be capable of accomplishing with or without supplemental engineer support.

The author of the new FM 90-10 (draft) highlights that large numbers of casualties occur in the urban environment as infantrymen move between buildings and negotiate obstacles.[84] Soldiers are often exposed to enemy fire for short periods of time in areas restricted to one or two persons. The complex urban terrain is three-dimensional and has increased demands upon the individual soldier as he attempts to move about the

urban environment. Each soldier is expected to demonstrate leadership competencies that apply to decentralized offensive operations in urban terrain. In order for soldiers to be mobile within the urban milieu, each soldier must have the leadership competencies of proficiency, physical stamina, and cognition to survive. Can even the best soldiers perform all their infantry tasks and mobility tasks with the assistance of new technologies or does he need engineer enablers?

The essential lessons learned are fundamentally the same in Somalia and Chechnya. Infantrymen must be extremely mobile to navigate through the complex urban environments such as Somalia and Chechnya in the future. The key lessons include:

1) Units must move in small, decentralized organizations capable of moving rapidly and still providing force protection.

2) Decentralized units must be organized and resourced to accomplish all anticipated tasks.

3) Units must be capable of protecting themselves within a three-dimensional environment.

4) Engagements occur at close ranges limiting stand off and time to react.

5) Soldiers must wear protective equipment and still conduct their tasks.

6) Too much equipment hinders soldiers with fatigue and degrades their manual dexterity.

7) The complex urban environment requires a myriad of special equipment to facilitate mobility of the unit due to various complex terrain features.

8) Successful detection and neutralization of mines and booby traps are essential

to successful mobility. (Particular emphasis on those used in unconventional methods)

9) Urban soldiers must maintain the ability to create field expedient means to bypass or enter areas to facilitate mobility.

10) Units must have the mechanical capability to remove mines and debris along main supply routes.

The AAN ACTD are addressing each of the critical mobility tasks identified in recent urban operations and are proposing technologies to affect many of the above lessons. The following analysis will use anticipated competencies of the AAN soldiers. It will examine the urban warrior's capability to perform his basic infantry tasks and the additional mobility tasks of detecting, locating, accessing, identifying/evaluating, and neutralizing mines and facilitating movement forward.

PROFICIENCY:

The first of the competencies the future urban soldier will have to attain is proficiency. Proficiency is the soldier's ability to perform the myriad of required tasks in the proper sequence in the required time to accomplish the mission. Historically, decentralized operations with small units require unique proficiencies to ensure mission success. Can the infantryman learn and be proficient in a myriad of infantry tasks as expected by the AAN proponents or does he need to be supplemented with engineer soldiers with special skills?

The field of behavioral psychology does not specify how many tasks an individual soldier can learn and perform with proficiency.[85] Most psychological sources recognize

there is a limit to what an individual can recall from memory and perform correctly. The U.S. Army Battle Focused Training manual, FM 25-101, focuses on reducing the number of individual and collective tasks to a manageable level. It states that the army should "plan to train a realistic number of tasks...better to train to standard on a few tasks then fail to achieve the standard on many."[86] This implies that the Army understands that there is a limit to what a soldier can do well. The ARTEP 7-8 MTP lists 85 common tasks and 70 MOS related tasks for the infantryman to perform. The future MTP will have a comparable amount, if not more. It is obvious that no one soldier can become proficient in all 155 tasks. Although not all tasks are urban related, infantrymen will still be expected to learn and train on all of them. Optimistically, the AAN will allow soldiers to focus on specific tasks to perform and train on prior to deploying into a particular environment.

The Army has experienced the complexity of training soldiers on various tasks in the recent past. The annual Common Task Training (CTT) test of basic tasks for all soldiers included over 30 tasks. However, each year, soldiers would continually fail to pass all the tasks, even after study and preparation, in a garrison environment. The tasks will only become more complex when superimposed with the conditions of urban warfighting.

The examination of proficiency must include the complexity of the task and if the task requires a high degree of the individual's attention. The task may require a great deal of manual dexterity or physical strength and coordination. The urban infantryman's tasks of fire and maneuver, reconnaissance, security, and countermining are considered complex and vigilant tasks. Infantryman must maintain situational awareness of the

members in their units to prevent fratricide. They must constantly be wary of threat forces and civilians in the environment. They have to react quickly and continue to advance through the complex terrain. Today, at Fort Benning, Georgia, young infantryman are trained in Advanced Individual Training for 13 weeks. During that time, they are trained on urban fighting for 7 hours in class and one day of a field training exercise.[87] They have zero hours of training on countermining operations.[88] Much of the urban experience is trained at the unit level. The Army training system will need to expand their program to include additional training on urban fighting in order to make the AAN soldier proficient in their tasks.

Future Technologies will enable the AAN soldier to reduce the number of required skills in the urban environment. The Land and Urban Warrior technologies will reduce the complexity of the required tasks by embedding technologies into current systems. The Land Warrior system will provide the situational awareness problem with direct feed to the IHAS. The built in radio system will allow continuous communications to coordinate movement. The computer will help the individual soldier gather battlefield information and operate the radios and the GPS. This saves time, and allows the soldier to be more efficient and effective in combat. Situational awareness is one of the greatest strengths/advantages that a soldier can have on the battlefield. The computer allows the integration of digital maps, GPS locations of both himself and other friendly units and known enemies, sensor systems on the weapon, and other external sensors. Integrating all of these provides the soldier with unprecedented situational awareness. These improvements enable the infantryman to maintain dispersion and increased security by reducing their signature.

The question of technological systems failing remains a concern. Therefore, a plan for redundancy should be addressed. The Land Warrior developers have addressed this concern. The Land Warrior system is designed to operate if the system fails. A low battery indicator is included as a design requirement. Current options include audio and/or visual indicators to warn the infantryman. If the system fails due to direct fire or other cause, a number of peripheral devices and sensors would continue to operate, such as the IHAS, radios, LRF/DCA, video camera, TWS, etc. If the IHAS fails, the soldier will still have view capability through the various other sight systems such as the TWS, backup Iron Sights, and Close Combat Optic. If the sensors fail, the soldier can still aim the weapon through the backup Iron Sights. He will always be able to fire his weapon. A down system does not equal a down soldier.[89] The same concerns must be present for the mobility requirements. If the mobility systems fail, the infantryman must be proficient or accept risk.

More importantly, future technologies will reduce the number of mental tasks that constantly occupy the soldier's mind allowing greater focus on required tasks. For example, the soldier no longer has to be concerned when his peers are out of physical view. Systems will cue him when others detect enemy activity or obstacles to their movement. However, reduced stand off will still be a problem for advanced technologies in that the soldier still has to react to unexpected threats as in Somalia.

Technology has not advanced as far in the realm of countermining. The methodology is still the same with the conduct of countermine operations consisting of detecting, locating, accessing, identifying/evaluating, and neutralizing. The conduct of countermine operations must be simplified. In the Explosive Ordnance Detachment

Report to Congress, the mobility task of countermining is defined as a complex task with training required. The task requires a high level of versatility because there are over 6,000 unexploded ordnance items that can be detonated in the world inventory.[90] A significant contributor to combat casualties are mines and booby-traps because mines are cheap, lethal, psychological disruptive, and readily available, and they will be encountered on all future battlefields. The result is that relatively cheap mines employed quickly and in quantity can immobilize a powerful force.[91] As infantrymen maneuver within the complex urban terrain they will encounter numerous antipersonnel mines hindering his progress as encountered by the Americans in Somalia and the Russians in Chechnya. Those soldiers fortunate enough to live after detecting a mine are often exposed to the threat for a large amount of time as they attempt to bypass or neutralize it. Therefore, if the infantryman is without engineers, he alone must be proficient in detecting, locating, accessing, identifying/evaluating, and neutralizing the mine/booby trap.

The ability to access mines and booby traps relies heavily on the skill of the individual operator or use of remote capabilities. Soldiers currently use helmets, body armor and additional gear called BASIC that increases the fatigue of the operator and inhibits his motions.[92] Current manual techniques of detection and neutralization require specialized tools.[93] One can anticipate that mines will become even more sophisticated in the future and more difficult to detect and neutralize.

The desired detection reliability in an urban environment must be 100 percent to prevent injury to fellow soldiers and noncombatants. Countermine operations in a high operational tempo of a conventional battle require a lower reliability in the range of 80-90

percent.[94] The complex urban terrain provides a significantly larger number of false encounters due to the large amount of metal and dense materials. Therefore, the infantryman will spend an estimated 70% of their time investigating all the false alerts to potential mines or booby traps.[95]

Engineers using man portable mine detectors with the capability to detect mines using audio monitoring conduct current detection methods in urban terrain. Additional methods include manual probing and visual identification. All methods require vigilance and have a high risk to individuals. For manual methods of neutralization, combat engineers use protective garments to reduce the hazards associated with inadvertent initiation of mines. The ensemble is called BASIC, Body Armor Set, Individual Countermine, which consists of kevlar helmet, flak vest, specialized leggings and overboots.[96] This protective gear is critical while the soldier accesses and neutralizes the mine in a complex step by step process that leaves the soldier exposed for periods of time. The Army cannot assume force protection measures will be successful and there will be minimal casualties to soldiers. Combat requires units to build in redundancy of skills based on anticipated losses.

ACTD are testing vehicular mounted mine detection systems to traverse over MSRs. The system is mounted to the front of a vehicle and provides imagery from IR sensors. The mine detection system requires a human to interpret imagery from IR and radar like the older man portable system that required a human to interpret various sounds. The task involves recognition of rapidly changing, unfamiliar imagery.[97] This is a vigilant tasks that requires, tedious monitoring. The tediousness of the task requires the rotation of personnel to prevent loss of attention. Audio cues may be available in the

future. The system will require a specialist in identifying the sources and clearing the mines. Infantryman could be used but would dissipate manpower away from the forward units.

Infantry can accomplish all mobility tasks with risk but will have to focus on the continual sophistication of the mine threat technologies. If the infantry alone has to achieve proficiency, the training system will have to reflect a new approach to training. Infantryman will have to train longer in military schools on complex mobility tasks or consider the implications of training exposure to a variety of tasks and then depending on technological software which allows a soldier to be coached remotely through the particular task process. There is a risk associated with this method as well.

The infantryman must be able to follow the software instructions to disarm the particular mine according to the steps and move on. Many may argue that a soldier cannot be successfully coached through steps without a cognitive awareness of the fundamental principles. A system with an online downlink similar to tele-medicine technologies may evolve over the software packages. However, everyone interprets directions differently based on their experiences. The Engineer Officer Advanced Course exercise on leadership shows the difficulty of articulating yourself. One person draws a picture and then instructs someone with his back to the speaker to follow their directions to draw the same picture. The results are seldom like the original due to differing interpretations of the instructions. However, when the two players were of the same background or specialty they used common references that reduced the variations in the drawings.[98] The bottom line is that infantryman resourced with equipment can conduct their mission and still perform reconnaissance, countermine and mobility operations. But

there will be a significant amount of risk associated with this. The foam technologies may be primary system in the future but like the flamethrower of World War II, the reservoir will empty over time and may not be replenished or it may be destroyed. Therefore, there is no redundancy in the system. An engineer specialist can provide that experience and skill and even innovation, if required. The nonspecialist infantryman may depend on his software as a step by step process to identify, disarm, or remove the mine. This increases the amount of time the soldier is exposed to direct and indirect fires compared to the specialist. The issue of greater time and training required in making the infantryman more diverse is a concern. New technologies do not eliminate the need for redundant systems. The army has precious little time available to expand schools and keep soldiers away from combat units.

PHYSICAL:

The leader competency of physical stamina is integral to the urban fighting soldier. A study of the soldier's load has been researched and documented beginning with the Germans in World War I and later S.L.A. Marshal resurrected the issue after World War II. German marching trials identified that no amount of training will ever condition an infantryman to carry excessive weight.[99] "MOUT is highly decentralized and is extremely demanding on individual's endurance and skills."[100] The British forces in Ireland identified the need to dramatically reduce combat loads in an urban environment because of the greater agility required.[101] The environment is extremely exhaustive both physically and mentally.

A 1997 study of fatigue and the ability of soldiers to carry a load reveal some significant conclusions that will affect soldiers in current and future complex urban terrain. Overloading soldiers with ammunition and equipment can lead to excessive fatigue and impair their ability to fight.[102] Current U.S. doctrine recommends a fighting load of 48.4 lbs (22 kg) or 30% of one's body weight.[103] The analysis shows a direct correlation of mass and performance. As mass was increased, there were systemic decreases in performance such as climbing ladders and negotiating obstacle courses. There was also decreased performance in accuracy of marksmanship and grenade throwing.[104] This does not bear well with the projected increase in mass of new technologies for infantrymen.

The current average weight an infantryman carries is 136 lbs (62 kg).[105] This includes his uniform, load bearing equipment and additional equipment. The projected weight will increase to 140.8 lbs (64 kg) based on future technologies.[106] If this is true, do we expect to burden the infantryman with additional engineer type equipment such as detection devices or foam delivery equipment?

However, he must carry a large amount of ammunition due to isolated operations and high consumption rates of small arms ammunition. This lesson was learned at the expense of American lives in Somalia. In addition, the infantryman is burdened with a wide variety of specialized equipment to facilitate movement in Chechnya. These two particular lessons appear contradictory and increase the physical and mental demands placed on each infantryman.

In order to be accepted by the Army, the Land Warrior System must weigh less than 80 pounds (including the TWS).[107] This weight was selected to represent the

current load being carried by today's soldier. The current weight of the system in development is 86 pounds.[108] The Land Warrior technology addresses the basic items but does not consider the specialized equipment.

In conclusion, the load the soldier carries into combat is a significant consideration. If the infantryman is responsible for a myriad of tasks that require additional equipment specific to urban fighting, the weight will have to be distributed to other members of the unit. The infantryman will have to reduce weight elsewhere by reducing ammunition or other necessities or increasing the weight per individual. The inherent risk is increased to the infantryman with a proportional increase in weight. Or the infantryman will be designated and resourced as the engineer equipment carrier. For all intentional purposes he is lost to the infantry mission. Soldiers must still remain agile and mobile to react quickly to threats. A designated engineer specialist would reduce his ammunition and carry mobility requirements reducing the burden on infantrymen. Once again, the acceptable level of risk must be addressed for the infantryman to accomplish all assigned tasks.

COGNITION:

Cognition is the final leader quality that future soldiers will be expected to exhibit. Cognition is the soldier's ability to recognize the correct tasks to perform within a decision cycle without losing momentum during his mission. Because of the reduced distance between the soldier and his opponent in the urban environment, the decision making cycle is reduced. Carl Von Clausewitz described the ability of the leader to make

a quick assessment of the situation and its requirements as coup d'oeil.[109] Coup d'oeil is a French term which means at a glance or a quick survey.[110] In a study by the Research Institute for the Behavioral and Social Sciences, researchers found that individuals performing a limited time task did not develop courses of action. It is virtually impossible to evaluate all options and make a decision. The experiment revealed the decisionmaker had to react based on experience.[111] It takes a lot of time to develop and consider all options along all evaluation criteria. Even reducing the amount of options and criteria still places an unreasonable load on the decision-maker.[112] Therefore, it is not acceptable to expect the future infantry soldier to be vigilant in seeking the enemy by observing, orienting, deciding, and acting and still remain vigilant in mobility tasks that must be performed quickly. In an urban environment, the task of detecting and locating mines and booby traps detracts from one's focus on the enemy. It is a soldier's coup d'oeil that helps him react quickly to a situation without wasting a lot of time. This is particularly true for the soldier that must reference his computer system in order to identify what tasks are required to perform and the soldier that immediately identifies the problem and has a solution quickly formulated.

The psychological impact of MOUT is arguably greater than any other form of battle. The presence of snipers has a psychological effect in battle as it causes soldiers to be concerned with being ambushed from above, below, or behind. Casualties may be much higher and evacuation of the wounded more difficult in urban areas. There are also the added moral dilemmas when innocent civilians are killed, and the threat that any civilian can be a potential enemy. All these factors detract from the soldier's cognitive abilities. This point was emphasized during the TF-160 operation in Mogadishu. The

inability of supporting arms to effectively engage some urban targets may also have a demoralizing affect that detracts from task focus. Finally, the door to door fighting, potential isolation, ever present obstacles, mine and booby-traps add to the high stress.

Most urban tasks require a great deal of vigilance. Researchers agree that humans are not well suited for vigilant tasks.[113] British forces in Belfast identified that soldiers were "burned out" after extended periods of time in urban fighting. Soldiers were mentally fatigued and required 2-4 hours of sleep when required to participate in vigilant tasks under stress.[114] Soldiers that had little sleep and were fatigued and required longer to formulate plans for decisions and would often forget steps in complex tasks. Specialization reduces the need to problems associated with fatigue and complex thinking.

The demands placed on small unit leaders to exercise the initiative required for success are high. Commanders must delegate decision-making authority to develop the skills required of subordinate commanders and leaders during MOUT.

Once again, based on the complexity of urban tasks, soldiers must depend on their coup d'oeil that is developed through experience and the repetitive nature of training assigned to specialist. The risk of infantryman performing so many tasks is that there is a delay as opposed to an instinctive reaction to complex tasks. A specialist allows a more rapid reaction time to both the infantryman and to the engineer supporting him.

CONCLUSIONS/RECOMMENDATIONS:

Somalia and Chechnya reveal a great deal of lessons that the Army cannot afford

to learn again in future battles in complex urban terrain. Technological developments for the infantryman will significantly improve their survivability and mobility. ACTDs are potentially eliminating the need for a combat engineer at the tactical level capable of reconnaissance of obstacles, providing explosive entry into buildings, and conducting their own countermine operations. However, there is an inherent risk associated with an infantry soldier displaying leader competencies of proficiency, physical stamina and cognitive skills related to complex tasks normally associated to engineers.

"Different technological apparatuses require not only different labor forces but different orders of supervision and coordination."[115] Therefore, the Army may conclude that as new AAN mobility technologies develop, new specialists must be trained to operate the equipment. In theory, engineers must consider Liddell Hart's theory of indirect approach and how best to provide mobility to the maneuver forces. Engineers must develop doctrinal concepts on how to create mobility by going over, under or through complex urban terrain. The concept of providing remotely operated systems to robotically conduct reconnaissance, mine detection, and neutralization appears to have promising potential. Current research is making quantum advances. These new technologies will require new skills and specialists capable of operating the equipment under adverse conditions in support of maneuver forces.

To reduce the risk of soldiers detecting, disarming mines or booby traps, future planning must focus more toward remote and standoff equipment that also reduces the collateral and environmental damage by techniques other than detonation and exposure of individuals. The future role of engineers should still include accompanying their brethren into the complex urban terrain. The future engineer should don a system similar to the

Land Warrior, but the system would be more focused on the role of robotic mobility support specialist in the urban environment. The two case studies show the role of the urban engineer must be decentralized based on independent movement of units. The future engineer would potentially control small expendable robots with a mine detection and/or neutralization capability. The remote ability to neutralize mines or booby traps would provide stand off to the infantrymen. The robots would have to be small enough to enter subterranean areas such as sewer systems. The system should have a live feed to the IHAS system of each member and with the communication system could be directed to move in specific directions. The engineer could position himself from a secure location and control multiple systems allowing freedom of maneuver to the infantry with live video feeds to the IHAS. For purposes of redundancy, the systems should include detachable equipment in case of system failure so the engineer can secure the gear and conduct manual techniques.

Based on the Russian experience in Chechnya, engineers need heavy engineer assets to support the light tactical forces. Future mobility considerations in complex urban terrain include the development of lightweight assault bridging to span craters created by subterranean explosions possibly collapsing roads into underground structures. Engineers moving closely behind the infantry will remove rubble to facilitate movement of wheeled traffic for continuous support. Engineers will need the capability to quickly assess the effects of using explosive breaches that may potentially provide significant collateral damage. Future urban structures will have to be assessed to prevent injuring soldiers and civilians by damaging utilities such as gas, electricity, etc. Engineers will require specialization to access superstructures such as dams, power plants and power

grid stations.

The last point is the sheer amount of infantry required to conduct urban operations. Infantryman focused on securing an area cannot afford to be attritted performing other missions. The complex urban environment requires direct observation by infantrymen and massive amounts of manpower conducting decentralized operations. This is due to an inability to control urban ground by distant observation and the geometric progression of going from two dimensions to three. "Panama City ate up every soldier we could throw into it, and we couldn't even begin to sweep the city," said Bob Wright, historical resources branch chief at the Army's Center of Military History.[116]

Although the future infantryman will have significant capabilities at his disposal, there is still a human being at the core that must demonstrate leader competencies under arduous conditions. It is the human being's enduring limitations that will hamper the efforts of the infantryman from performing all required tasks in the future. It is beyond the scope of human capabilities to train an infantry soldier to execute all required mobility tasks and to carry and employ future weapon systems that allow him to defeat an enemy and survive in a complex urban environment. Mobility is the key element of future AAN concepts and engineers specializing in new mobility technologies will be an enabler, reducing risk, to the future infantryman as more advanced concepts develop and allow common technologies to be used by infantrymen.

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